Introduction to Gunk

The Modern Toolkit for Building Microservices

Jason Wangsadinata
Systems Developer @ Brankas

First and foremost…

- Thank you to:
  - GoJakarta + ScaleJakarta for organizing.
  - Xendit office for hosting.
  - All of you guys for attending.

A little bit about myself

- **Jason Wangsadinata**
- `@jwangsadinata`
- Systems Developer @ Brankas
- Passionate about building scalable services and finding best practices to do so.

How do we make computers talk to each other?

How do we make *applications* that can talk to each other?

Web APIs

SOAP

REST

HTTP + JSON

(REST is not the above btw)

Why HTTP/REST?

- It is easy to understand (*text protocol*)
- Web infrastructure is already built on top of HTTP
- Great tooling for testing, inspection, modification
- Loose coupling between client/server makes changes relatively easy
- High-quality http implementations in every language

Why HTTP/REST - continued…

- **JSON**
  - It is simple
  - Looks like plain JavaScript object / Python dictionaries
  - XML was a little bit too verbose
- Movement away from SOAP(xml) towards REST

Looks like REST is perfect, bye…

Not quite…

- **JSON + HTTP is nice but it is not a silver bullet**
- It is not the best when:
  - **Performance matters**
  - Readability does not really matter
  - **Type safety is required**
  - Standard contract between applications/computers are needed (continued next page…)

Why REST API is not so good?

- **No formal (machine-readable) API contract**
  - Writing client libraries requires humans
  - **Humans (myself included) hate writing client libraries**
- Streaming is difficult
- Bi-directional streaming is not possible at all
- Inefficient (text representation are not efficient for networks)
- Hard to get many resources in a single request (think GraphQL)

“If I never write another REST client library in my life **I will die happy**”

- Alan Shreve, ngrok

Protocol Buffers

- Protocol buffers are a language-neutral, platform-neutral extensible mechanism for serializing structured data
- Google's Interface Description Language (IDL)
- Think XML, but smaller, faster, and simpler
- Has data types like `message`, `enum` and `service`.
- Language and platform neutral

GRPC: What is it?

- A high performance, open-source, universal RPC framework
- It stands for **g**RPC **R**emote **P**rocedure **C**alls
- Part of Cloud Native Computing Foundation (cncf.io)
- Open-source version of *Stubby* used in *Google.*

GRPC — continued

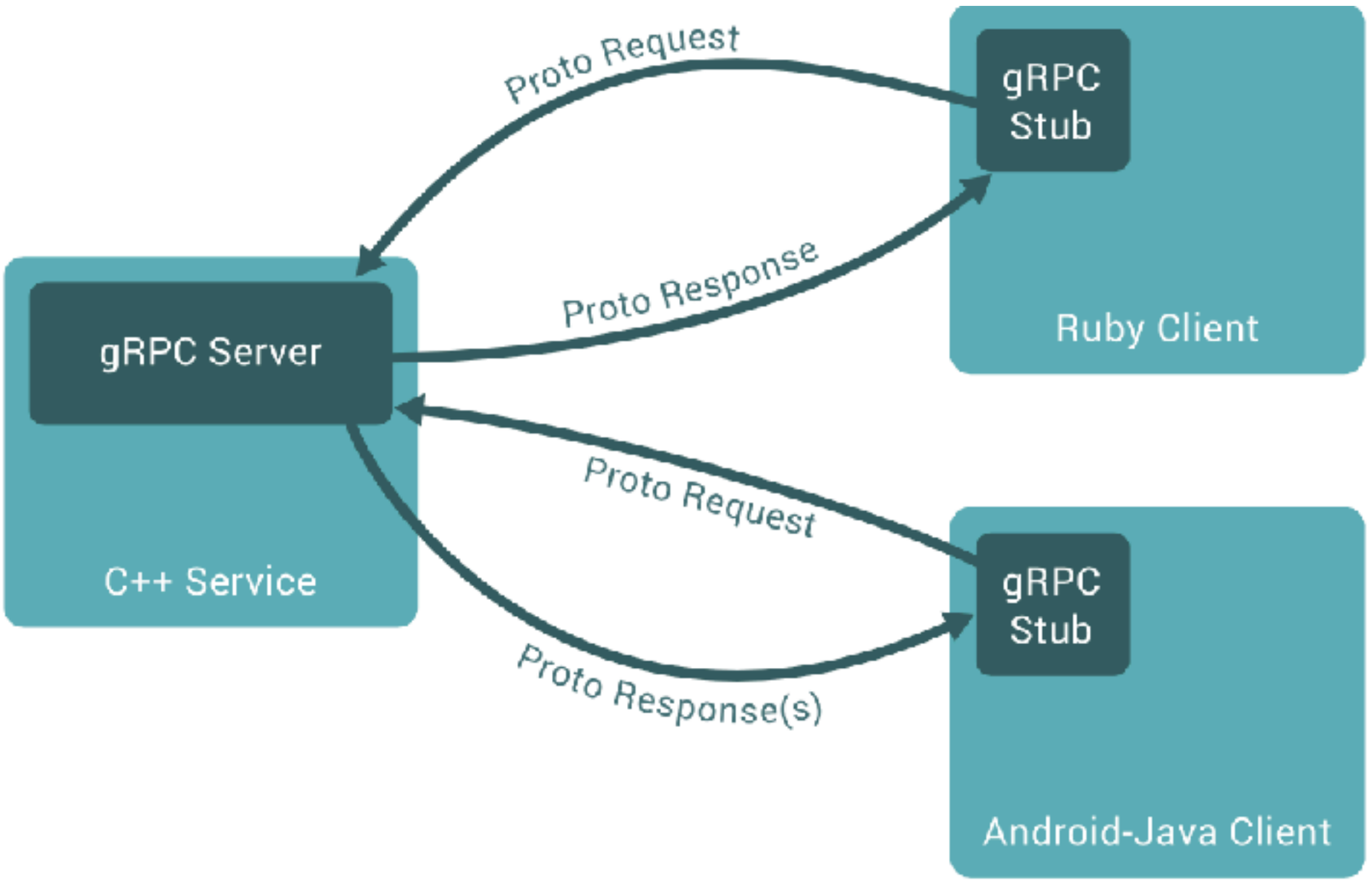
- Abstractions and best practices on how to design RPCs
- Default implementation(s) from Google
- Extension points to plug custom implementations and modifications
- Supports 10+ programming languages

- In particular, Go has first class support for *protobuf* and *gRPC*.

GRPC: On the wire

- HTTP/2
- `protobuf` serialization (pluggable)
- Clients open one long-lived connection to a GRPC server
  - A new HTTP/2 stream for each RPC call
    - Allows simultaneous in-flight RPC calls
- Allows client-side and server-side streaming

- Built on:
  - `HTTP/2, IDL, protobufs`


Proto Request
gRPC
Stub
Proto Response
gRPC Server
Ruby Client
Proto Request
gRPC
Stub
C++ Service
Proto Response(s)
Android-Java Client

GRPC: Implementation

- Three high-performance event loop driven implementations
- **Go**
  - Pure Go implementation using Go stdlib `crypto/tls` package
- **C**
  - Ruby, Python, Node.js, PHP, Objective-C, C++, C# are all bindings to the `C Core`
  - PHP via PECL extension (apache or nginx/php-fpm)
- **Java**
  - Netty + BoringSSL via JNI

enough background, tell me about gunk

Gunk

- Wrapper around the protobuf's `protoc` compiler.
- It stands for "**G**unk **U**nified **N**-terface **K**ompiler".
- Written in simple and idiomatic Go.
- Intuitive to use.

Why build Gunk?

- Create an Go-compatible way of defining definitions that can be read and handled by `go/*` package.
- Less overhead in compiling the API definitions.
- Write an intuitive tool to quickly generate and build services.

Gunk file

```
package pokemon

type PokemonService interface {
	Get(GetReq) Pokemon
}

type GetReq struct {
	ID int `pb:"1" json:"id"`
}

type Rarity int

const (
	NORMAL Rarity = iota
	LEGENDARY
	MYTHIC
)

type Pokemon struct {
	Name   string `pb:"1" json:"name"`
	ID     int    `pb:"2" json:"id"`
	Rarity Rarity `pb:"3" json:"rarity"`
}
```

Gunk file

```
package pokemon

type PokemonService interface {
	Get(GetReq) Pokemon
}

type GetReq struct {
	ID int `pb:"1" json:"id"`
}

type Rarity int

const (
	NORMAL Rarity = iota
	LEGENDARY
	MYTHIC
)

type Pokemon struct {
	Name   string `pb:"1" json:"name"`
	ID     int    `pb:"2" json:"id"`
	Rarity Rarity `pb:"3" json:"rarity"`
}
```

Looks like a regular `.go` file to me?

Gunk file vs protobuf file

```
package pokemon

type PokemonService interface {
	Get(GetReq) Pokemon
}

type GetReq struct {
	ID int `pb:"1" json:"id"`
}

type Rarity int

const (
	NORMAL Rarity = iota
	LEGENDARY
	MYTHIC
)

type Pokemon struct {
	Name   string `pb:"1" json:"name"`
	ID     int    `pb:"2" json:"id"`
	Rarity Rarity `pb:"3" json:"rarity"`
}
```

```
syntax = "proto3";
package pokemon;

service PokemonService {
    rpc Get (GetReq) returns (Pokemon) {}
}

message GetReq {
    int32 id = 1;
}

message Pokemon {
    string name = 1;
    int32 id = 2;

    enum Rarity {
        NORMAL = 0;
        LEGENDARY = 1;
        MYTHIC = 2;
    }

    Rarity rarity = 3;
}
```

Gunk file vs protobuf file

```
package pokemon

type PokemonService interface {
	Get(GetReq) Pokemon
}

type GetReq struct {
	ID int `pb:"1" json:"id"`
}

type Rarity int

const (
	NORMAL Rarity = iota
	LEGENDARY
	MYTHIC
)

type Pokemon struct {
	Name   string `pb:"1" json:"name"`
	ID     int    `pb:"2" json:"id"`
	Rarity Rarity `pb:"3" json:"rarity"`
}
```

```
syntax = "proto3";
package pokemon;

service PokemonService {
    rpc Get (GetReq) returns (Pokemon) {}
}

message GetReq {
    int32 id = 1;
}

message Pokemon {
    string name = 1;
    int32 id = 2;

    enum Rarity {
        NORMAL = 0;
        LEGENDARY = 1;
        MYTHIC = 2;
    }

    Rarity rarity = 3;
}
```

Gunk file vs protobuf file

```
package pokemon

type PokemonService interface {
	Get(GetReq) Pokemon
}

type GetReq struct {
	ID int `pb:"1" json:"id"`
}

type Rarity int

const (
	NORMAL Rarity = iota
	LEGENDARY
	MYTHIC
)

type Pokemon struct {
	Name   string `pb:"1" json:"name"`
	ID     int    `pb:"2" json:"id"`
	Rarity Rarity `pb:"3" json:"rarity"`
}
```

```
syntax = "proto3";
package pokemon;

service PokemonService {
    rpc Get (GetReq) returns (Pokemon) {}
}

message GetReq {
    int32 id = 1;
}

message Pokemon {
    string name = 1;
    int32 id = 2;

    enum Rarity {
        NORMAL = 0;
        LEGENDARY = 1;
        MYTHIC = 2;
    }

    Rarity rarity = 3;
}
```

Gunk file vs protobuf file

```
package pokemon

type PokemonService interface {
	Get(GetReq) Pokemon
}

type GetReq struct {
	ID int `pb:"1" json:"id"`
}

type Rarity int

const (
	NORMAL Rarity = iota
	LEGENDARY
	MYTHIC
)

type Pokemon struct {
	Name   string `pb:"1" json:"name"`
	ID     int    `pb:"2" json:"id"`
	Rarity Rarity `pb:"3" json:"rarity"`
}
```

```
syntax = "proto3";
package pokemon;

service PokemonService {
    rpc Get (GetReq) returns (Pokemon) {}
}

message GetReq {
    int32 id = 1;
}

message Pokemon {
    string name = 1;
    int32 id = 2;

    enum Rarity {
        NORMAL = 0;
        LEGENDARY = 1;
        MYTHIC = 2;
    }

    Rarity rarity = 3;
}
```

Gunk file vs protobuf file

```
package pokemon

type PokemonService interface {
	Get(GetReq) Pokemon
}

type GetReq struct {
	ID int `pb:"1" json:"id"`
}

type Rarity int

const (
	NORMAL Rarity = iota
	LEGENDARY
	MYTHIC
)

type Pokemon struct {
	Name   string `pb:"1" json:"name"`
	ID     int    `pb:"2" json:"id"`
	Rarity Rarity `pb:"3" json:"rarity"`
}
```

```
syntax = "proto3";
package pokemon;

service PokemonService {
    rpc Get (GetReq) returns (Pokemon) {}
}

message GetReq {
    int32 id = 1;
}

message Pokemon {
    string name = 1;
    int32 id = 2;

    enum Rarity {
        NORMAL = 0;
        LEGENDARY = 1;
        MYTHIC = 2;
    }

    Rarity rarity = 3;
}
```

Usage

```
$ gunk
usage: gunk [<flags>] <command> [<args> ...]

Gunk Unified N-terface Kompiler command-line tool.

Flags:
  -h, --help  Show context-sensitive help (also try --help-long and --help-man).

Commands:
  help [<command>…]
    Show help.

  generate [<flags>] [<patterns>...]
    Generate code from Gunk packages.

  convert [<flags>] [<file>]
    Convert Proto file to Gunk file.

  format [<patterns>...]
    Format Gunk code.
```

Usage

```
$ gunk
usage: gunk [<flags>] <command> [<args> ...]

Gunk Unified N-terface Kompiler command-line tool.

Flags:
  -h, --help  Show context-sensitive help (also try --help-long and --help-man).

Commands:
  help [<command>…]
    Show help.

  generate [<flags>] [<patterns>...]
    Generate code from Gunk packages.

  convert [<flags>] [<file>]
    Convert Proto file to Gunk file.

  format [<patterns>...]
    Format Gunk code.
```

Usage

```
$ gunk
usage: gunk [<flags>] <command> [<args> ...]

Gunk Unified N-terface Kompiler command-line tool.

Flags:
  -h, --help  Show context-sensitive help (also try --help-long and --help-man).

Commands:
  help [<command>…]
    Show help.

  generate [<flags>] [<patterns>...]
    Generate code from Gunk packages.

  convert [<flags>] [<file>]
    Convert Proto file to Gunk file.

  format [<patterns>...]
    Format Gunk code.
```

Usage

```
$ gunk
usage: gunk [<flags>] <command> [<args> ...]

Gunk Unified N-terface Kompiler command-line tool.

Flags:
  -h, --help  Show context-sensitive help (also try --help-long and --help-man).

Commands:
  help [<command>…]
    Show help.

  generate [<flags>] [<patterns>...]
    Generate code from Gunk packages.

  convert [<flags>] [<file>]
    Convert Proto file to Gunk file.

  format [<patterns>...]
    Format Gunk code.
```

enuf talk, let’s gunk

Write the server

```
package main

// imports are truncated on this slide for clarity

type Server struct{}

func (s *Server) Get(ctxt context.Context, req *pb.GetReq) (*pb.Pokemon, error) {
     // TODO: write the service implementation here
}

func main() {
     l, err := net.Listen("tcp", ":9090")
     if err != nil {
          log.Fatal(err)
     }
     s := grpc.NewServer()
     reflection.Register(s)
     pb.RegisterPokemonServiceServer(s, &Server{})
     log.Fatal(s.Serve(l))
}
```

Write the server

```
package main

// imports are truncated on this slide for clarity

type Server struct{}

func (s *Server) Get(ctxt context.Context, req *pb.GetReq) (*pb.Pokemon, error) {
     // TODO: write the service implementation here          -> write the server logic here
}

func main() {
     l, err := net.Listen("tcp", ":9090")
     if err != nil {
          log.Fatal(err)
     }
     s := grpc.NewServer()
     reflection.Register(s)
     pb.RegisterPokemonServiceServer(s, &Server{})
     log.Fatal(s.Serve(l))
}
```

Write the server

```
package main

// imports are truncated on this slide for clarity

type Server struct{}

func (s *Server) Get(ctxt context.Context, req *pb.GetReq) (*pb.Pokemon, error) {
     // TODO: write the service implementation here
}

func main() {
     l, err := net.Listen("tcp", “:9090")                    -> bind to a port for serving
     if err != nil {
          log.Fatal(err)
     }
     s := grpc.NewServer()
     reflection.Register(s)
     pb.RegisterPokemonServiceServer(s, &Server{})
     log.Fatal(s.Serve(l))
}
```

Write the server

```
package main

// imports are truncated on this slide for clarity

type Server struct{}

func (s *Server) Get(ctxt context.Context, req *pb.GetReq) (*pb.Pokemon, error) {
     // TODO: write the service implementation here
}

func main() {
     l, err := net.Listen("tcp", “:9090")
     if err != nil {
          log.Fatal(err)
     }
     s := grpc.NewServer()                                   -> initialize a new server
     reflection.Register(s)
     pb.RegisterPokemonServiceServer(s, &Server{})
     log.Fatal(s.Serve(l))
}
```

Write the server

```
package main

// imports are truncated on this slide for clarity

type Server struct{}

func (s *Server) Get(ctxt context.Context, req *pb.GetReq) (*pb.Pokemon, error) {
     // TODO: write the service implementation here
}

func main() {
     l, err := net.Listen("tcp", ":9090")
     if err != nil {
          log.Fatal(err)
     }
     s := grpc.NewServer()
     reflection.Register(s)                                  -> enable reflection service
     pb.RegisterPokemonServiceServer(s, &Server{})
     log.Fatal(s.Serve(l))
}
```

Write the server

```
package main

// imports are truncated on this slide for clarity

type Server struct{}

func (s *Server) Get(ctxt context.Context, req *pb.GetReq) (*pb.Pokemon, error) {
     // TODO: write the service implementation here
}

func main() {
     l, err := net.Listen("tcp", ":9090")
     if err != nil {
          log.Fatal(err)
     }
     s := grpc.NewServer()
     reflection.Register(s)
     pb.RegisterPokemonServiceServer(s, &Server{})              -> register service to our server
     log.Fatal(s.Serve(l))
}
```

Write the server

```
package main

// imports are truncated on this slide for clarity

type Server struct{}

func (s *Server) Get(ctxt context.Context, req *pb.GetReq) (*pb.Pokemon, error) {
     // TODO: write the service implementation here
}

func main() {
     l, err := net.Listen("tcp", ":9090")
     if err != nil {
          log.Fatal(err)
     }
     s := grpc.NewServer()
     reflection.Register(s)
     pb.RegisterPokemonServiceServer(s, &Server{})
     log.Fatal(s.Serve(l))                                    -> start serving
}
```

Write the client

```
package main

// imports are truncated on this slide for clarity

func main() {
    conn, err := grpc.Dial(“localhost:9090”, grpc.WithInsecure())
    if err != nil {
        log.Fatalf("did not connect: %v", err)
    }
    defer conn.Close()
    c := pb.NewPokemonServiceClient(conn)

    ctx, cancel := context.WithTimeout(context.Background(), time.Second)
    defer cancel()
    r, err := c.Get(ctx, &pb.GetReq{ID: int32(25)})
    if err != nil {
        log.Fatalf("could not get: %v", err)
    }
    log.Printf("Pokemon #%d is %s (%s)", r.ID, r.Name, r.Rarity.String())
}
```

Write the client

```
package main

// imports are truncated on this slide for clarity

func main() {
    conn, err := grpc.Dial(“localhost:9090”, grpc.WithInsecure())          -> connect to the server
    if err != nil {
        log.Fatalf("did not connect: %v", err)
    }
    defer conn.Close()
    c := pb.NewPokemonServiceClient(conn)

    ctx, cancel := context.WithTimeout(context.Background(), time.Second)
    defer cancel()
    r, err := c.Get(ctx, &pb.GetReq{ID: int32(25)})
    if err != nil {
        log.Fatalf("could not get: %v", err)
    }
    log.Printf("Pokemon #%d is %s (%s)", r.ID, r.Name, r.Rarity.String())
}
```

Write the client

```
package main

// imports are truncated on this slide for clarity

func main() {
    conn, err := grpc.Dial(“localhost:9090”, grpc.WithInsecure())
    if err != nil {
        log.Fatalf("did not connect: %v", err)
    }
    defer conn.Close()
    c := pb.NewPokemonServiceClient(conn)                    -> init the client stub

    ctx, cancel := context.WithTimeout(context.Background(), time.Second)
    defer cancel()
    r, err := c.Get(ctx, &pb.GetReq{ID: int32(25)})
    if err != nil {
        log.Fatalf("could not get: %v", err)
    }
    log.Printf("Pokemon #%d is %s (%s)", r.ID, r.Name, r.Rarity.String())
}
```

Write the client

```
package main

// imports are truncated on this slide for clarity

func main() {
    conn, err := grpc.Dial(“localhost:9090”, grpc.WithInsecure())
    if err != nil {
        log.Fatalf("did not connect: %v", err)
    }
    defer conn.Close()
    c := pb.NewPokemonServiceClient(conn)

    ctx, cancel := context.WithTimeout(context.Background(), time.Second)  -> set context
    defer cancel()
    r, err := c.Get(ctx, &pb.GetReq{ID: int32(25)})
    if err != nil {
        log.Fatalf("could not get: %v", err)
    }
    log.Printf("Pokemon #%d is %s (%s)", r.ID, r.Name, r.Rarity.String())
}
```

Write the client

```
package main

// imports are truncated on this slide for clarity

func main() {
    conn, err := grpc.Dial(“localhost:9090”, grpc.WithInsecure())
    if err != nil {
        log.Fatalf("did not connect: %v", err)
    }
    defer conn.Close()
    c := pb.NewPokemonServiceClient(conn)

    ctx, cancel := context.WithTimeout(context.Background(), time.Second)
    defer cancel()
    r, err := c.Get(ctx, &pb.GetReq{ID: int32(25)})                    -> call the client stub
    if err != nil {
        log.Fatalf("could not get: %v", err)
    }
    log.Printf("Pokemon #%d is %s (%s)", r.ID, r.Name, r.Rarity.String())
}
```

Write the client

```
package main

// imports are truncated on this slide for clarity

func main() {
    conn, err := grpc.Dial(“localhost:9090”, grpc.WithInsecure())
    if err != nil {
        log.Fatalf("did not connect: %v", err)
    }
    defer conn.Close()
    c := pb.NewPokemonServiceClient(conn)

    ctx, cancel := context.WithTimeout(context.Background(), time.Second)
    defer cancel()
    r, err := c.Get(ctx, &pb.GetReq{ID: int32(25)})
    if err != nil {
        log.Fatalf("could not get: %v", err)
    }
    log.Printf("Pokemon #%d is %s (%s)", r.ID, r.Name, r.Rarity.String())  -> use the response
}
```

Verify that the service works

- Start the server
  - `$ cd server`
  - `$ go build && ./server`
- In another window, start the client
  - `$ cd client`
  - `$ go build && ./client`
- Verify that the client received the response

demo time

State and future of gunk

- Currently under active development.
- Enable support for all major languages and plugins.
- Allow support for grpc streams.
- Ramp up on project documentation.

Contributing

- Try it! Best way to contribute is to actually use the project.
- Document any issues you encounter using the issue tracker.
- Features you want to see? Also raise it via the issue tracker.
- Know a better implementation/solution, send PR our way.

Shameless plug

- A copy of this slide is available on my GitHub (https://github.com/jwangsadinata/talks/intro-to-gunk)
- If you like these kinds of stuff, check out Brankas (https://brank.as).
- Definitely join the meetup group for GoJakarta and ScaleJakarta
  - **GoJakarta** (https://www.meetup.com/GoJakarta/)
  - **ScaleJakarta** (https://www.meetup.com/ScaleJakarta/)
- I recently wrote a Kubernetes utility called k8shhh, check it out and give it some love:
  - `k8shhh` (https://github.com/jwangsadinata/k8shhh)
- Shoutout to Jonathan Pentecost and Daniel Martì for their contributions and inputs.

questions?

terima kasih